THE EFFECT OF NATURAL GAS ON TREES AND OTHER VEGETATION[1]

by Spencer H. Davis, Jr.

When manufactured gas was used in homes and industry, a leak in the gas main could result in sudden death to nearby vegetation. The death of plants was acknowledged by all to be the result of toxic components such as cyanogen which formed hydrocyanic acid when mixed with water and carbon monoxide. It was simple to determine if manufactured gas was present in soil atmosphere by placing a potted tomato plant in a hole in the "suspect" area. If manufactured gas was present, another of its components — ethylene — resulted in severe epinasty of the tomato leaves within 24 hours.

With the swing to use of natural gas the question arose whether a gas leak in soil could injure plants. It was known that natural gas in itself was apparently non-toxic to plants. However, the death of trees and other vegetation in the vicinity of a gas leak in soil was still quite common.

Natural gas was known to be dryer than manufactured gas, and the gas companies were soon faced with an increased number of gas leaks as natural gas dried out the packing at the joints of underground pipes, and the leaks resulted.

Despite the dead vegetation in the vicinity of natural gas, there were those who claimed that non-toxic gas could not possibly be responsible for death of vegetation. However there were those who would refute this. A speaker at the 1958 annual meetings of the New Jersey Federation of Shade Tree Commissions was Mr. Milton W. Heath, Jr., of the Heath Survey Consultants, Wellesley, Massachusetts. The Heath Company operated a service of detecting gas leaks in soil, serving over 650 utility companies in 47 states. Two excerpts from the presentation by Mr. Heath are as follows:

"Let me state beforehand that our Company ha been locating gas leaks by the effects of gas on vegetation for over 25 years, and the transition from manufactured gas to natural gas has not impaired the ability of our consultants to accomplish this whatsoever. In fact, the overall effects are more striking with natural gas in many instances than they were with manufactured gas, one reason being the increased pressures natural gas is distributed under, which results in greater volume loss."

"Some will contend that there is no effect on vegetation from natural gas but again, as I mentioned previously, our experience proves otherwise and, in fact, our business functions as a result of this fact that vegetation IS affected by this gas."

For a number of years some utility companies refused to accept claims against them for trees allegedly killed by gas leaks when natural gas was involved. However, one of these companies, even though originally claiming "no fault" did pay the City of New York for "Trees apparently killed by natural gas." (*New York World Telegram*, July 13, 1961; and *Daily News*, July 14, 1961.)

Tests conducted by Braverman, Ettinger and Jacobs, and reported in the technical section of *Gas Age*, April 26, 1962, described the results of their determination of air quality in soil where natural gas was associated with dead trees. They reported higher percentage of methane, up to 10% carbon dioxide, and less than 5% oxygen in soil near recently killed trees. By contrast, they observed a lack of methane, 3 to 4% carbon dioxide, and 20% oxygen in the root area of healthy trees. Their final comment was — "The results obtained in this set of experiments are fairly consistent. In the absence of any counter evidence it appears that trees are damaged and killed by methane and the concomitant lack of oxygen."

For years scientists, as well as the industrialists who recognized that vegetation would die in the vicinity of natural gas leaks, did not know the chain of events leading up to the plant death. It was conjectured that the natural gas under pressure replaced the oxygen in the soil which

[1] Presented to the National Arborist Assn. seminar on pollution damage to trees, December 1976, at New Brunswick, N.J.

was so necessary for root survival and also that its extreme dryness caused roots to die from dehydration.

It was not until 1972 that the scientific answer to the question of gas damage was established and reported in a paper in *Soil Science*, Volume 113, pages 46-54. In that paper "Changes in Composition in Soil Air Near Leaks in Natural Gas Mains" by J. Hoeks, the reason was presented. The paper begins "During the last four or five years because of its disastrous influence on plantations in towns and villages, leakage of natural gas from underground mains has become a real problem in the Netherlands and also in other Western European Countries." The paper then goes on to describe the experiments:

Natural gas containing approximately 82% methane, 14% nitrogen, 1% carbon dioxide and minor quantities of other hydrocarbons, was released in the "normal soils." The normal soil had an oxygen content of approximately 18%, and 3% carbon dioxide.

After a period of gas release (varying number of weeks, pressures and temperatures), the oxygen concentration became extremely low, almost zero percent, and the carbon dioxide rose to up to 15%. The extremely low oxygen concentration is regarded as the most important cause of death of the trees.

The low oxygen content may be caused in part by the displacement of the soil air by the leaking gas, but much more so by intensive oxygen consumption as a result of methane oxidation. Methane consuming bacteria multiply in methane contaminated soil using up the oxygen and giving off carbon dioxide.

The microbiologic investigation proved that the oxidation of methane is brought about by methane consuming bacteria and the oxygen is depleted during the process. In a normal soil in which there is no natural gas, there are few or no methane consuming bacteria. Therefore, just after the start of a gas leak the rate of oxidation of the methane is slow. However, after a period of time the methane utilizing bacteria increase and in turn the concentration of oxygen in the soil will decrease.

As stated by Heath in 1958, and accepted by many observers during the interim when natural gas has pretty much displaced manufactured gas, trees and other vegetation did die in the vicinity of gas leaks in soil even though the scientific reasons were not known.

The results described by Hoeks in his recent paper now give us the scientific answers to the question, "Why do plants die as a result of leaks of natural gas in soil?"

Department of Plant Pathology
Cook College-Rutgers University
New Brunswick, N.J.

TREE PRESERVATION EDUCATION FOR BUILDERS AND DEVELOPERS IN CHARLOTTE, NORTH CAROLINA

by Donald B. McSween, John M. McNeary, and F. Philip Neumann[1]

Abstract. In order to protect Charlotte's trees, we areattempting to educate builders, developers, and public agencies about tree values, physiology, protection, and planting. We feel that such education backed up by practical regulation will in the long run result in more real gains with less restriction on individual freedom.

Charlotte, as most other cities and towns in the country,isfacedwiththeseeminglyopposing problems of growth and natural environment preservation. Many communities have in recent years gone the route of regulation to achieve a balance between the two. We in Charlotte, on the other hand, have had a growing commitment to the concept of education backed up by reasonable and practical regulation. We feel that in the long run education will make more real gains with less restriction on individua freedom.

As a first step in this direction, the Charlotte Tree Commission appointed a committee consisting of the three authors of this paper to

[1] Assistant Extension Agent, Urban Forestry, Mecklenburg County, Agricultural Extension Service, North Carolina State University at Raleigh; President of McNeary's Arborists, Inc., Charlotte, North Carolina and City Arborist, Landscaping/Cemeteries Division, Department of Public Works, Charlotte, North Carolina, respectively.